

Team LunaCY Outreach Paper

NASA Lunabotics Mining Competition

Iowa State University Lunabotics

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Astronaut Clayton Anderson poses with Art-E and members of team LunaCY.

Introduction

Iowa State University's Lunabotics Club, Team LunaCY, has worked hard to generate enthusiasm for robotics, engineering, and lunar activities. Team LunaCY participated in a variety of different outreach events making a strong impression on Iowa youth. These events led the chair of the mechanical engineering department, Dr. Ted Heindel, to refer to the club's outreach program as "the model that all other engineering clubs should follow." Team LunaCY's outreach activities totaled over 200 hours and captivated over 3000 students and adults throughout the course of this academic year, reaching out to people all over Iowa and to several special guests. These guests included Vice-President Joe Biden ([Figure 1](#)), during a visit to Iowa State University in March 2012, and astronaut Clayton Anderson ([cover page](#)), during a visit to Iowa State's campus in the fall 2011.



Figure 1: ISU Lunabotic's member Katie Goebel explains the manufacturing behind ART-E's tapered wing pulley to Vice-President Joe Biden.

Team LunaCY's outreach events created hands on learning opportunities for local youth ranging in age from elementary school children to high school students. The team strove to make a positive impression on Iowa youth and to encourage interest and involvement in scientific fields. The full list of events is shown in [Table 1](#) below. Three of the major outreach events the team participated in were the FIRST LEGO League, Science Bound, and iExplore STEM Festival.

Event	Dates	Cumulative team member hours	Number of Team Members	Number of Attendees	Average Age of Attendees
ISEK Camp	6/16/2011	8	4	50	5-10
Engineering Welcome Fest	9/1/2011	8	4	200	18-25
Clubfest I	9/8/2011	20	3	400	18-25
iExplore STEM Festival	9/18/2011	20	5	750	all ages
Middle School Day	10/25/2011	20	4	150	12-14
Ames FRC High School Visit	10/26/2011	8	4	15	14-18
Science Bound	10/29/2011	15	5	15	14-16
Urbandale High School Visit	11/2/2011	4	4	50	14-18
Dowling High School Visit	11/2/2011	4	4	30	14-18
Fellows Elementary School Visit	11/8/2011	6	3	25	9-10
Engineering Design Expo	12/6/2011	12	3	150	11-25
FIRST LEGO League in Cedar Rapids	12/10/2011	25	5	500	9-14
FIRST LEGO League State Competition	1/14/2012	18	6	200	9-14
Edwards Elementary School Visit	1/23/2012	9	3	75	5-11
Clubfest II	1/26/2012	20	3	300	18-25
Engineering Tour Groups	2/26/2012	6	2	150	16+

Table 1: Summary of outreach events

FIRST Lego League (FLL)



Figure 2: Team LEGOLightning, an FLL team, learns how many of the same principles applied to build their robot were used to build ART-E.

FLL Cedar Rapids Regional

On December 10, 2011 members of Team LunaCY traveled to Cedar Rapids, IA to introduce children to Lunabotics at a FIRST LEGO League regional competition. FIRST LEGO

League is a national organization designed to create interest in science and technology among youth. ART-E II's demonstration of operations generated sparks of excitement that attracted a constant crowd of children and adults, many of whom had the opportunity to control the robot. Team LEGO Lightning (pictured in *Figure 2*) was inspired to model their track system after

ART-E II's triangular shaped tracks when the team saw ART-E II featured in "Dimensions" (Volume No. 20,

Issue No. 1), a publication for alumni of the Mechanical Engineering Department at Iowa State University. A local FIRST Robotics Team, Team 967, was so intrigued by ART-E II's demonstration that they engaged some Team LunaCY members in a detailed discussion of ART-E II's systems and mechanical design. Because of the overwhelming response, Team LunaCY is confident it left a strong impression on all of the students involved at the FIRST LEGO League Regional.

FLL State Competition

The state competition for the Iowa LEGO League was held at Iowa State University on January 11, 2012. The outreach activity for this event included a short presentation, with an informal question and answer session for local middle school students. The students showed great interest in ART-E II and many got the chance to control and drive it around campus. During the presentation, team members explained the NASA Lunabotics mining competition and showed the students a number of similarities between ART-E II and their robots. For example, ART-E II was programmed using LabView, while the students use LEGO Mindstorms, a similar programming language. Such comparisons helped students make connections between their projects and real-world robotic applications.



Figure 3: Students at the FIRST LEGO League state competition learn about ART-E II.

Science Bound



Figure 4: Participants prepare their modified robots for robotic soccer

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"From their visit, I learned many things about the challenges of robot building...I acquired many things from the ISU Lunabotics team and hope that I can apply some of that knowledge to our team's robot. "

- Bojun Song, Ames High School Student

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The students were then challenged to replicate Art-E II's mining process by controlling it with a joystick. Many of them were thrilled at this opportunity and began to ask numerous questions regarding the robot. After the demonstration, the students were divided into four groups and each group was given a GEARS remote controlled robot. The GEARS robots are small vehicular robots designed to teach the students the basics of robotics. The team tasked the groups of students with constructing a shovel on the front of the vehicles' carts that would enable them to "play" soccer. The only constraint was the materials allowed: the shovel had to be constructed using only paper and tape. This activity concluded with a robotic soccer tournament, shown in [Figure 5](#). Overall, the Lunabotics Science Bound activity left a major impression on the students, and many walked away with a newfound interest in robotics and engineering.

On October 29th, 2011, Team LunaCY was given the opportunity to organize an engineering activity for over 20 students from local high schools through the Science Bound program. Science Bound is an Iowa State University sponsored program designed to inspire ethnically diverse students to pursue careers in science and technology. During the beginning of the activity, Team LunaCY gave a twenty minute presentation to the students. The goal of the presentation was to give the students a basic overview of the NASA Lunabotics Competition, explain the entire

building process of Art-E II, and describe engineering challenges and how they were overcome. After the

presentation, Art-E II's mining capabilities were demonstrated, highlighting the important mechanical functions of the robot and how they worked. The students

were then challenged to replicate Art-E II's mining process by controlling it with a joystick. Many of them were thrilled at this opportunity and began to ask numerous questions regarding the robot. After the demonstration, the students were divided into four groups and each group



Figure 5: The robots are ready for the countdown to kickoff.

iExplore STEM Festival

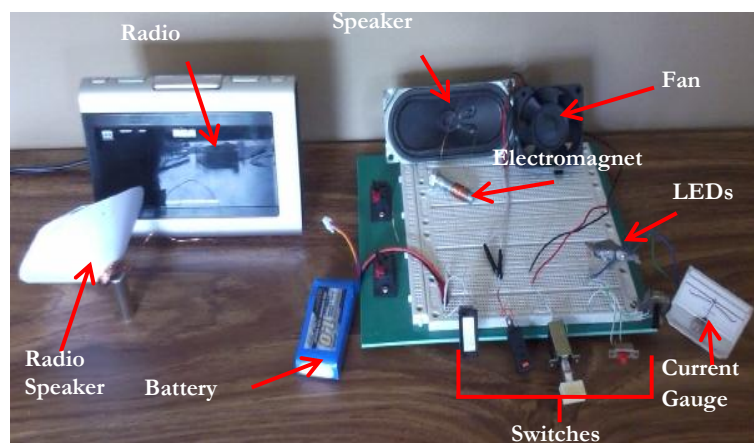


Figure 6: A simple hands on experiment showed kids how batteries can run various small electronics, by simply connecting wires.

assembled a variety of small devices powered by a breadboard. These devices included a miniature propeller, an LED with a dimmer switch, a speaker cone, and many more electronics as seen in [Figure 6](#). The kids had the opportunity to interact with these devices as team members explained how electricity allowed the systems to function. Team members challenged the participants to figure out which buttons would activate each component by following the wires that were attached to the breadboard. The second display set up was a homemade speaker built using a sheet of paper, a copper coil, and a magnet. The goal of this demonstration was to show students that the same interaction between a magnetic field and an electric field that powers an electric motor can be used to design speakers. The team explained that the copper coil was connected to the radio, and it sent out a pulsing magnetic force when an electric current passed through it. This vibrated a cone that was rolled using the sheet of paper when it was placed near the magnet. The children were amazed when they heard the paper speaker work.

To conclude the demonstration, team members explained how everything that the participants learned from the previous demonstrations can be applied to ART-E II. The participants learned that ART-E II was made up of many different motors that allowed it to move and switches that controlled many of its functions. Many of the kids wanted to know more about robotics and what they should do in order to become involved in robotics. In the future, LunaCY hopes to continue working with iExplore STEM in an effort to continue the promotion of engineering, robotics, and lunar activities.

The largest outreach event that LunaCY attended was the iExplore STEM festival, an event designed to foster interest in science and technology for Iowa children and families. On September 18, 2011, members of Team LunaCY travelled to Coralville, Iowa to interact with over 700 kids of all ages attending the festival. To demonstrate the basic concepts of electricity, the team had



Figure 7: A festival attendee controls ART-E as a member of team LunaCY explains how the robot works.

Conclusion



Figure 8: Several Team LunaCY members visited the Ames First Robotics team.

groups to carry the success of this year's activities into the future. Team LunaCY hopes to continue to grow its outreach programs, enthusing youth and all ages about robotics, engineering, and lunar activities

Team LunaCY's outreach focus this year was to make lasting impressions of science, engineering, and lunar activities on young students. The team engaged a variety of people with age appropriate material and hands-on activities. The opportunity to teach and learn with Iowa youth was enjoyed by all team members who participated. The team worked hard to build strong relationships with many outreach



Figure 9: Team LunaCY was featured in many news articles and even a magazine. These articles showcased various activities in which team members participated (Articles taken from various sources, which can be provided upon request)